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WORK STATEMENT GUIDE

FOR

RELIABILITY AND QUALITY ASSURANCE

PROVISIONS

FACILITY FORM 602

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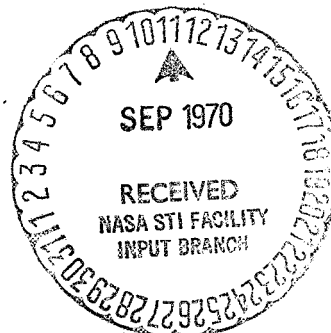
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APOLLO R&QA OFFICE
MANNED SPACE FLIGHT
WASHINGTON, D.C.

INTRODUCTION

The purpose of this guide is to assist Center Contracting Officers in simplifying and clarifying the specification and degree of Reliability and Quality Assurance requirements in Requests for Proposals to potential Apollo Program contractors.

This document is a compilation of R&QA disciplines for Apollo Program Hardware and Software, and consists of three (3) basic inter-related sections.

SECTION I

This section consists of a series of (1) Reliability Discipline Charts and (2) Quality Assurance Discipline Charts. Each R&QA discipline is followed by one or more references to Apollo Program and/or NASA documents as the authority for that discipline. Also following each discipline are references to six designated hardware development phases. The designations correspond to those in the Apollo R&QA Program Plan, NPC 500-5. Disciplines appropriate to each phase are indicated by asterisks (*) below the appropriate phase(s).

Based on inputs from the Center R&QA Office, the Contracting Officer may then specify on the RFP selected R&QA hardware disciplines (from the charts) and their appropriate hardware development phases that the contractor must implement on a particular contract.

SECTION II

This section of the guide delineates R&QA Software (documentation) requirements pertinent and necessary for the optimum performance of Apollo contracts.

R&QA Software requirements are outlined on NASA Form 1106. The first two charts list the titles, the pertinent NPC 250-1 paragraph numbers and the document classification or type of Reliability documentation. The remaining three charts list Quality Assurance documentation primarily as based on NPC 200-2, but also including reference to NPC 500-5 and NPC 400.

Preceding the R&QA Software charts is a page defining document classification (type). Documents are defined as Types I, II, III and IV corresponding to those documents requiring submission to NASA for approval, review or information, and those to be available for NASA review upon request, respectively. Also included in this section are suggested instructions and guidelines for the preparation and completion of NASA Form 1106 by the Contracting Officer. The selection and specification of appropriate R&QA documentation on the RFP is considerably simplified through the utilization of these charts by the Center C.O.

SECTION III

The third and last section of this guide includes representative examples of complete Work Statements for R&QA requirements that might appear in a Request for Proposal to potential contractors.

Work Statement examples define the discipline; its authority; schedules and milestones; performance specifications; documentation; and all other requirements and constraints pertinent to that discipline. The examples may also be used as a source of standard and preferred terminology, and may be used as a typical checklist of parameters to consider in the preparation of the RFP by the Contracting Officer.

This guide is based on and includes R&QA requirements of documents such as Apollo Program Development Plan NPC C500, NASA Procurement Regulation NPC 400, Apollo Documentation Administration Instruction NPC 500-6, Apollo R&QA Program Plan NPC 500-5 as well as NPC 200-2, NPC 200-3, NPC 250-1 and NPC 500-10.

SECTION I

THIS SECTION INCLUDES RELIABILITY AND QUALITY ASSUR-
ANCE HARDWARE REQUIREMENTS BY DEVELOPMENT PHASE FOR
THE APOLLO PROGRAM.

RELIABILITY REQUIREMENTS FOR
APOLLO PROGRAM HARDWARE

ITEM	RELIABILITY PROGRAM DISCIPLINES
1	Mission Profile Analysis
2	Reliability Goal Analysis based on the Apollo Program Specification (SE 005-001-1)
3	Goal Apportionment Analysis (Subsystems and Systems)
4	Apportionment Model Development (Hardware)
5	Reliability Program Plan Development
6	Reliability Evaluation Plan Development
7	Program Management and Control
8	Task Monitoring and Surveillance Organization
9	Data Collection and Analysis
10	Program Documentation Administration per NPC 500-6
11	Status Reporting (Trends and Events)
12	Technical Reporting
13	Prediction Model Development
14	Analysis of Feasible Alternatives to Achieve Goals
15	Program for Control of Government Furnished Property
16	Program Audits (Center/Contractor/Subcontractor)
17	Design Specification Reviews
18	Functional Block Diagrams
19	Logic Diagrams
20	Failure Mode, Effect and Criticality Analyses
21	Maintainability Analysis
22	Redundancy Requirements (Equipment, Human, Logistics)
23	Selection of Reliability and Proven Parts and Materials

AUTHORITY

APOLLO R&QA PROGRAM PLAN NPC 500-5
HARDWARE DEVELOPMENT PHASE

		NPC 400 PARA 1.5106	NPC C500 PARA NO.	NPC 500-5 PARA NO.	NPC 500-10 PARA NO.	NPC 250-1 PARA NO.	STUDY/DEF PARA 2.2.2	DESIGN PARA 2.2.3	MANUF & CO PARA 2.2.4	TEST & CO PARA 2.2.5	PRE-LAUNCH PARA 2.2.6	POST FLIGHT PARA 2.2.7
		10.6.1	4.7a(1)			*	*(c)	*	*	*(g)	*	
		10.3	2.3.6			*(c)	*	*	*	*	*	
		10.3	4.7a(5)			*	*	*	*	*	*	
		10.6.9	4.4		3.2.2	*	*(g)					
	(b)i,ii	10.5.4	3.4a		2.2	*(a)	*(a)	*	*			
	(b)i,ii	10.5.4	3.4a		4.2		*(q)	*	*			
	(b)iii		3.4b		2.4	*	*	*	*			
	(a)	10.7	2.4.4		2.1	*	*	*	*			
	(a)iv	10.6.11	2.2.8a 2.5		5.1	*	*	*	*	*	*	*
	(a)iv	4.2	2.3.9a		5.1	*	*	*	*	*	*	*
	(b)xiii	10.6.12	2.2.8b 5.4		5.2	*	*	*	*	*	*	*
	(b)xiii	10.6.12	2.2.8b 5.4		5.3	*	*	*	*	*	*	*
	(b)vii	10.6.9	4.4		3.3	*(b)	*(e)	*	*	*	*	*
					3.4	*(d)	*	*	*	*	*	
	(b)vi				2.7	*	*	*	*	*	*	*
		10.6.12	2.2.8d 6.3		2.3 2.4	*	*	*	*	*	*	*
					3.2		*(w)	*(f)	*			
			4.7a(3)		3.2.2		*(b)	*(h)	*			
			4.7a(4)		3.4		*(b)	*(h)	*	*	*	*
		10.6.2	2.7 4.7a(6)		3.4		*(d)	*(g)	*	*	*	*
	(a):				3.5		*(k)	*	*	*	*	
		10.6.8			3.3		*(i)	*	*	*	*	
	(b)ix,i	10.6.5	7.4.2		3.9.2		*(m)	*	*			

RELIABILITY REQUIREMENTS FOR
APOLLO PROGRAM HARDWARE

ITEM	RELIABILITY PROGRAM DISCIPLINES
24	Lists of Approved Parts and Materials
25	Designation of Parts Requiring Serialization and Traceability
26	Program to Minimize Human-Induced Failures
27	Parts and Materials Application Reviews
28	Configuration Management Program per NPC 500-1 PARA 6.0
29	Logistics Planning and Management per NPC 500-3
30	Design Review Program (Contractor/Subcontractor)
31	Program Requirements Invoked on Subcontractors
32	Resident Representative Monitoring of Subcontractors
33	Trade-off Analyses
34	Failure Reporting, Analysis, Correction and Data Feedback System.
35	Designation of Limited Life, Operating Time & Critical Stress Items
36	Standardization and Control of Design and Drafting Practices
37	Overall Test Program per NPC 500-10
38	Parts Qualification Test Program
39	Program Reviews
40	Reliability Demonstration Test Program
41	Checkout Test Program
42	Acceptance and Rejection Criteria Development (End-Items)
43	End-Item Acceptance Test Program
44	Standardization and Control of Process Specifications
45	Supply Requirements
46	Equipment Log Program

	NPC 400 PARA 1.5106	NPC C500 PARA NO.	NPC 500-5 PARA NO.	NPC 500-10 PARA NO.	NPC 250-1 PARA NO.	STUDY/DEF PARA 2.2.2	DESIGN PARA 2.2.3	MANUF & CO PARA 2.2.4	TEST & CO PARA 2.2.5	PRE-LAUNCH PARA 2.2.6	POST FLIGHT PARA 2.2.7
			7.4.3		3.9.5	*	*	*			
	10.6.5	7.4.10				*(n)	*	*			
(a)i				3.5		*(l)	*	*	*	*	
				3.9.6		*(w)	*(f)	*			
	5.2					*(h) *(x)	*(c)	*(b)	*(c)	*	
(a)i	6.2	2.3.8		3.5		*	*	*	*	*	
	10.6.4			3.6		*(w)	*(f)	*			
(b)iv				2.6.2		*	*	*	*		
(b)v				2.6.3		*	*	*	*		
	10.6.8			3.3		*(f)	*	*	*		
(b)viii	10.6.11	2.6 7.4.7		3.7		*(r)	*(m)	*(g)	*	*(c)	
				3.10		*(o)	*	*	*		
(a)ii				3.8		*	*	*			
(c)iii(A)		2.3.3 2.3.10		4.1		*(u)	*	*	*	*	
		7.4.6		3.9.4		*(v)	*(j)	*(c)	*(e)		
				2.3		*(w)	*(f)	*	*		
(b)xi	12.4.3	2.3.3 2.3.10	3.7	4.3.4		*(v)	*(k)	*(d)			
	12.4.4	2.3.10	3.8.8				*	*(j)	*	*(e)	
(c)iii	10.6.7			4.3.3			*	*			
(c)iii(C)		2.3.3 2.3.10	3.8	4.3			*(l)	*(e)			
		7.4.8		3.8			*	*			
(a)i	5.3			3.5			*	*	*	*	
				3.10			*(n)	*(h)	*(e)	*	



QUALITY REQUIREMENTS FOR
APOLLO PROGRAM HARDWARE

ITEM	QUALITY PROGRAM DISCIPLINES
1	Organizations and Responsibilities
2	Quality Assurance Requirements
3	Support to Reliability Program
4	Quality Assurance Program Plans/inspection Plans
5	Inspection, Measuring, & Test Equipment
6	Quality Assurance Program Audit
7	System Perf., Maint., Envir., & Test Req'ts. in Specifications
8	Quality Characteristics
9	Government Q. A. Actions
10	Design & Specification Reviews
11	Selection of Parts
12	Selection of Sources
13	Critical Items
14	Identification for Traceability
15	Change & Configuration Control
16	Special Process Controls
17	Personnel Training
18	Qualification & Requalification Testing
19	Program Reviews
20	Data Reporting
21	Data Analysis & Corrective Action

APOLLO R&QA PROGRAM PLAN NPC 500-5

HARDWARE DEVELOPMENT PHASE

[illegible]

QUALITY REQUIREMENTS FOR APOLLO PROGRAM HARDWARE

[illegible]

SECTION II

THIS SECTION INCLUDES THE DOCUMENT REQUIREMENT LIST (DRL) LISTING OF RELIABILITY AND QUALITY ASSURANCE SOFTWARE REQUIREMENTS FOR THE APOLLO PROGRAM.

PREPARATION INSTRUCTIONS FOR THE (DRL) AND THE DOCUMENT REQUIREMENT DESCRIPTION (DRD) WITH AN EXPLANATION OF DOCUMENT TYPES ARE SHOWN ON ATTACHMENT 1.

Attachment I

Classification - The documentation listed herein shall be classified by types as follows:

- Type I - Documentation requiring written approval by the procuring activity prior to implementation into the procurement or development program.
- Type II - Documentation received by the procuring activity for review not later than four weeks prior to project implementation.
- Type III - Documentation submitted to the procuring activity for coordination, surveillance, or information.
- Type IV - Documentation, retained by the contractor, that is to be made available to the procuring activity upon request. The contractor shall furnish a list, by subject, to the procuring activity.

PREPARATION INSTRUCTIONS

The Document Requirements List (DRL), NASA Form 1106 should be prepared in accordance with the requirements of NPC 500-6, Apollo Documentation Instruction (ADAI).

A Document Requirements Description (DRD), NASA Form 1107 should be prepared in accordance with the requirements of NPC 500-6 for each document listed on the DRL.

1. TITLE

2. RFP NO.

3. CONTRACT NO.

APPROVAL OF BLREAL OF
BUDGET NOT REQUIRED

[illegible][illegible]

DETACH THIS SECTION BEFORE DATING OR CONTRACTING

SECTION III

THIS SECTION INCLUDES REPRESENTATIVE EXAMPLES OF
RELIABILITY AND QUALITY ASSURANCE WORK STATEMENTS
INCLUDED IN REQUESTS FOR PROPOSALS.

WORK STATEMENT

1.0 RELIABILITY

1.1 General

The contractor shall develop and implement a reliability program plan in accordance with the provisions of NPC 250-1 and instructions contained in the following paragraphs. This reliability program plan, when approved in writing by the contracting officer, shall become a part of the Work Statement of the contract.

The object of the reliability program shall be to assure that the probability of successful performance of the technical requirements as specified (in appendix x) is 0. at % confidence.

(If additional reliability goals are desired, they should be inserted here)

1.2 NPC 250-1 Definitization

1.2.1 General

Wherever the term "cognizant NASA installation appears in NPC 250-1, it shall mean (MSC - ASPO - R&QA).

1.2.2 Specific paragraphs of NPC 250-1

The following instructions refer to specific paragraphs of NPC 250-1 as indicated.

2.3 Reliability program reviews shall be conducted each (January and July) as well as at major milestones in the program and as requested by the contractor.

2.4 (Give specific guidance on those aspects of control for which the NASA installation has special requirements and, if appropriate, for the preferred system of control.)

2.6 (List those elements of the system considered by NASA to be "Major" in terms of the need for reliability control by a formal reliability program. The list may be identified as "suggested" where it is desired to obtain contractor inputs for subsequent negotiation.)

2.6.3 (Indicate those of the system elements listed as "major" which are considered by NASA to require use of resident prime contractor representatives in subcontractor facilities. This list may be identified as "suggested" where it is desired to defer the final decision until specific information on subcontracts is proposed.)

2.7 Components and subsystems which will be furnished to the contractor by NASA for inclusion in his equipment are identified in (Table X). Operating and physical characteristics and necessary reliability data are also included in (Table X).

3.2.1 (It is possible that "mission profile performance requirements" may not be appropriate for use with this contract. If so, amend the statement to read "operational performance requirements".

3.2.2 The maximum period between submitting updated functional block diagrams shall not exceed (three months).

3.3 (Specify the milestone or time at which the initial prediction is required and the succeeding major or intermediate milestones at which revised predictions are required. Also, if appropriate, prescribe the method of prediction to be used and furnish detailed supplemental guidance.)

3.4 a) A Failure Mode and Effect Analysis (FMEA) shall be performed on end item equipment design in accordance with NPC 250-1 Paragraph 3.4 or (applicable Center documents).

b) A criticality analysis by criticality class or number shall be performed on each end item equipment design in accordance with (applicable Center Document).

3.5 The contractors efforts concerning Maintainability and Elimination of Human Induced Failures shall be based on MIL-M-26512B and MIL-STD-803.

3.7 (If a specific format and numbering system is desired, so specify.)

3.8 Modifications to the contractors existing standards and specifications will be kept to a minimum, consistent with equipment requirements. NASA Design Criteria to be incorporated in the contractor's and subcontractor's design standards systems is contained in Appendix X. (or) there is no requirement to incorporate NASA Design Criteria in the contractor's or subcontractor's design standards systems.

3.9.1 (On some contracts, it may not be desirable to have the contractor establish a group of parts and materials specialists. In such cases, indicate that paragraph 3.9.1 is not a requirement.)

3.9.2 (Table X) Lists parts already proven on other systems. The contractor shall use these parts where applicable so as to limit the scope of his parts selection effort.

3.9.3 (Table X) Lists the specifications for parts already proven on other systems, or Table X lists the specifications (for parts already proven in other systems) provided with this requirement.

4.3.4 Reliability demonstration tests will be conducted in accordance with section 3.7 of NPC 500-10. The Reliability Evaluation Plan shall identify all items of hardware and the number of each type to be subjected to reliability demonstration tests.

4.4 Reliability assessments shall be scheduled and performed (at 3 month intervals) . The assessments shall be an updating of the predictions of paragraph 3.3 of NPC 250-1

5. Documentation of Reliability Program

The contractor shall furnish or have available the documentation listed in the "Document Requirements List" (DRL), NASA form 1106. This list will be accompanied by a specific "Document Requirement Description" (DRD) for each document on the DRL. (See Examples)

The references to types of documentation in the title column are explained in Attachment I.

8/12/65

QUALITY ASSURANCE PROVISIONS

NPC 200-3 CONTRACTS

- 1.1 "Wherever the phrase 'cognizant NASA installation' is used, it shall mean (NASA Center governing the procurement)."
- 1.2 "The Supplier shall establish and maintain an inspection system which satisfies the requirements of NASA Quality Publication NPC 200-3 'Inspection System Provisions for Suppliers of Space Materials, Parts, Components and Services'."
- 1.4 "Detailed reliability requirements are stated in the Reliability Section of this work statement (Section).
- 1.5 When inspection plans for specific subcontractors or for subcontractors of specific equipment are required to be transmitted through the prime contractor to the (NASA Center) for review or approval, the subcontractors or equipment shall be listed. Transmittal of these plans shall be in accordance with the Document Requirements List (DRL).

Example: "The following subcontractors are required to submit inspection plans to the (prime contractor) for transmittal to the (NASA Center):"

2.2 "The supplier shall prepare and maintain a written inspection plan which shall be submitted to the (NASA Center) in accordance with the Document Requirements List (DRL), NASA Form 1106 which is a part of this work statement (Appendix ___)."

3.1 "When the prime contractor invokes NPC 200-3 in subcontracts, the subcontractor shall furnish the required documentation to him. The prime contractor shall forward copies to the (NASA Center) or its designated representative in accordance with the DRL."

"An equivalent specification proposed by the prime contractor in lieu of NPC 200-3 for procurements, shall be submitted to the (NASA Center) for review at least two weeks prior to its use in procurement documents."

When so required by the procuring agency for off-the-shelf and commercial items, the following statement shall be included in the work statement:

"All receipts at the contractor's plant, including 'off-the-shelf' and commercial items, shall be clearly identified and this identity maintained in storerooms and during processing in order that items procured under NASA contract may be readily recognized."

- 3.3 When it is anticipated or determined that Government Furnished Property (GFP) will be furnished to the supplier, specific instructions regarding the testing, inspection and handling of the GFP shall be included in the work statement. Also, when GFP is to be used as is without further inspection or testing, this shall be stated.
- 3.5 "Suppliers of fabricated articles shall supply test specimens of raw materials with the fabricated articles for verification tests as required by the (NASA Center)."
- 3.6 Inspections and tests desired but not contained in specifications and standards referenced in this work statement shall be stated.
- 3.7 Any special processes such as plating, anodizing, radiography, magnetic particle and liquid penetrant inspection, heat treating, welding, soldering, etc., and/or equipment which are required to be approved or certified shall be stated. Any requirements for personnel certification shall be stated.
- 3.11 Any special packing and marking requirements that differ from ICC Regulations shall be stated.
- 3.12 Requirements for sampling inspection, if applicable, or special instructions for screening inspection in lieu of sampling shall be stated.
- 3.13 Requirements for mechanical or electronic data processing shall be stated.

8/12/65

QUALITY ASSURANCE PROVISIONS

NPC 200-2 CONTRACTS

1.2 "Wherever the phrase 'cognizant NASA installation' is used, it shall mean (NASA Center governing the procurement)."

1.2 "The contractor shall establish and maintain an effective quality program to satisfy, as a minimum, the requirements of NASA Quality Publication NPC 200-2, 'Quality Program Provisions for Space System Contractors'."

1.2 When the provisions of NPC 200-2 are to be applied to specific major subcontracts, the contract shall state the subcontractor and/or equipment to which this provision applies.

1.4 "Detailed reliability requirements are stated in the Reliability section of this work statement (Section ____)."

1.5 When quality program plans for specific subcontractors or for subcontractors of specific equipment are required to be transmitted through (prime contractor) to the (NASA Center) for review or approval, the subcontractor or equipment shall be listed. Transmittal of these plans shall be in accordance with the Document Requirements List (DRL). Example: "The following subcontractors are required to submit quality program plans to (prime contractor) for transmittal to the (NASA Center):"

4.4 A listing of all generic items that do not require serialization of identification by lot number after fabrication shall be included in the work statement.

5.1 Any waiver of contractor responsibility for certain specific procured items shall be stated; e.g.

"Contractor responsibility is waived for the adequacy and quality of the following items and articles."

5.3.1 "When the prime contractor invokes NPC 200-2 or NPC 200-3 in subcontracts, the subcontractor shall furnish required documentation to him. The prime contractor shall forward copies to the (NASA Center) or designated representative in accordance with the DRL.

An equivalent quality requirements document proposed by the prime contractor in lieu of NPC 200-3 for procurements shall be submitted to the (NASA Center) for review at least two weeks prior to inclusion in procurement documents."

5.7 When so required by the procuring agency for "off-the-shelf" and commercial items, the following shall be included in the work statement:

"All receipts at the contractor's plant, including 'off-the-shelf' and commercial items, shall be clearly identified and this identity maintained in storerooms and during processing in order that items procured under NASA contract may be readily recognized."

2.2 "Quality Program Documentation shall be prepared and submitted as defined in the Document Requirements List (DRL) NASA Form 1106 which is a part of this work statement (Appendix ____)."

3.1.1 "The preliminary Quality Program Plan shall be prepared according to the requirements of NPC 200-2, Paragraph 3.1.1 and submitted with the proposal in accordance with the DRL.

The final Quality Program Plan is a detailed amplification of the preliminary plan and shall be submitted after contract award in accordance with the DRL."

4.2.2 "Applicable preferred parts lists to be included in this contract are attached as Appendix ____." When the contractor is required to establish preferred parts lists, the types of parts shall be described in the work statement.

4.3.1 Any additional requirements beyond NPC 200-2, Paragraph 4.3.1, for documentation and submittal of qualification test procedures shall be described.

4.3.5 "The qualification status lists shall be submitted for approval to the (NASA Center) initially and at intervals in accordance with the DRL."

4.4, When electronic or mechanized data processing is required by the
4.2.1 procuring agency, the requirements for such data processing shall be defined in the work statement.

6.1 When it is anticipated or determined that Government Furnished Property (GFP) will be supplied to the contractor, specific instructions regarding the testing, inspection, and handling of the GFP shall be included in the work statement. Also, when GFP is furnished to be used as is without further testing and inspection, this shall be stated.

11.6e Any special packing and marking requirements that differ from the ICC rules and regulations shall be stated.

13.2 The special processes and inspection techniques requiring certified personnel shall be stated; e.g. "Certification shall be required for personnel engaged in the following specialized process and inspection activities: _____, _____, _____."

14.3 The extent of laboratory facilities to be established and failure analysis function to be performed by the contractor at the launch site shall be stated. Time periods for notification of failures and malfunctions and for initiation of corrective action shall be stated.

WORK STATEMENT MANUAL

R&QA REQUIREMENTS

MAY 18, 1966

4.0

R&QA Requirements

The succeeding paragraphs indicate contractual requirements necessary for development and implementation of an R&QA Program. There are 3 sections covering general R&QA requirements, specific Reliability oriented requirements and specific Quality oriented requirements. In some cases suggested samples of specifically worded contract items are included; in the remainder of cases, the contract requirement is explained with the wording left up to the contract author.

4.1

General Requirements

4.1.1

Program Plan

Indicate the basis for the program plan as well as any special instructions and exceptions. The following wording is suggested:

"The contractor shall develop and implement an R&QA Program Plan in accordance with the provisions of NPC 250-1, NPC 200-2, the ____ (Program name) ____ R&QA Program Plan and instructions and exceptions in following paragraphs of this article (article ____). This contractor R&QA Program Plan, when approved in writing by the contracting officer, shall become a part of the Work Statement of this contract. If conflict exists between the provisions of any of the above mentioned documents and those of the approved contractor R&QA Program Plan, the latter shall have precedence."

4.1.2

Reliability Goal

Where hardware is involved there will undoubtedly be a Reliability Goal requirement. The following wording is suggested:

"The object of the Reliability Program shall be to assure that the probability of successful performance of the contractual end-item(s) in accordance with technical requirements as specified in ____ (indicate performance specification numbers) ____ is ____ 0. ____ from ____ (starting point of operation performance) ____ for ____ (period of operation) at ____ % confidence." (If additional reliability goals are desired, they should be inserted here).

4.1.3

Cognizant NASA Installation

As long as NPC 250-1, NPC 200-2 and NPC 200-3 govern R&QA activities of the contractor, the following statement should appear in the contract:

"Wherever the term 'cognizant NASA installation' appears in NPC 250-1, NPC 200-2 or NPC 200-3, it shall mean ____ (Insert NASA Center governing the procurement) ____."

4.1.4

Program Reviews

(Reference NPC 250-1, par. 2.3)

Specify the frequency of R&QA Program reviews as follows:

"R&QA program reviews shall be conducted at least ____ (indicate bi-annual, quarterly, monthly, or whatever frequency is desired), as well as at the following major milestones: ____ (identify the milestones) ____ . Additional reviews will be scheduled when requested by the customer."

4.1.5

Program Control

(Reference NPC 250-1, para. 2.4; and NPC 200-2, para. 3.2)

Give specific guidance on those aspects of Program Control for which the NASA Procurement governing agency has special requirements and, if appropriate, indicate the preferred system of control.

4.1.6

Documentation

(Reference NPC 250-1 para. 5.1; and NPC 200-2, para. 2.2).

The following is suggested wording:

"The contractor shall furnish or have available the documentation listed in the Document Requirements List (DRL), NASA Form 1106, (Appendix ____ of the work statement). This list will be accompanied by a specific Document Requirement Description (DRD) for each document on the list."

4.1.7

Reporting Requirements

(Reference NPC 250-1, para. 5.2 & 5.3; and NPC 200-2, para. 14.2).

Reporting requirements for the R&QA Program may be detailed in the R&QA requirements or they may be listed in another article of the contract, or they may appear in both places. Wherever they appear, be sure that any requirements in addition to those listed in NPC 250-1 and NPC 200-2 are noted and described as to content, frequency and recipient. If the requirements appear in more than one place, they should be cross-referenced.

4.2

Specific Reliability Oriented Requirements

4.2.1

Reliability Math Models

(Reference NPC 250-1, para. 3.3, & 4.4).

The following wording is suggested:

"The contractor shall develop and maintain Reliability math models and shall use these models as a basis for

4.2.2

(Reference NPC 250-1, para. 3.2.2).

"The maximum period between submitting updated functional block diagrams shall not exceed _____ months."

4.2.3

(Reference NPC 250-1, para. 3.3 & 4.4)

+

4.2.4

Special Reliability Controls

(Reference NPC 250-1, para. 2.6)

List those elements of the system considered by NASA to be "major" in terms of the need for special reliability control by a formal reliability program. The list may be identified as "suggested" where it is desired to obtain contractor inputs for subsequent negotiation.

Indicate those elements of the system considered by NASA to be "major" so as to require the use of resident prime contractor representatives in subcontractor facilities. This list may be identified as "suggested" where it is desired to defer the final decision until specific information on subcontracts is proposed.

4.2.5

Failure Mode, Effect, & Criticality Analysis

(Reference NPC 250-1, para. 3.4)

Insert the following words:

"A criticality analysis by criticality class ~~or~~ number shall be performed on each end item equipment design in accordance with (applicable NASA Center Document)."

By number only

4.2.6

Mission Profile

(Reference NPC 250-1 para. 3.2.1)

It is possible that "mission profile performance requirements" may not be appropriate for use with this contract. If so, amend the statement to read "operational performance requirements."

4.2.7

Standardization of Design Practices

(Reference NPC 250-1, para. 3.8)

Modifications to the contractors existing standards and specifications will be kept to a minimum, consistent with

equipment requirements. Use either of the following two suggested wordings:

"NASA Design Criteria to be incorporated in the contractor's and subcontractor's design standards systems is contained in Appendix _____."

- or -

"There is no requirement to incorporate NASA Design Criteria in the contractor's or subcontractor's design standards systems."

4.2.8

Parts & Materials

(Reference NPC 250-1 para. 3.9.1, 3.9.2, & 3.9.3; and NPC 200-2 para. 4.2.2).

On some contracts, it may not be desirable to have the contractor establish a group of parts and materials specialists. In such cases, indicate that paragraph 3.9.1 of NPC 250-1 is not a requirement. The following additional wording is suggested:

"A list of preferred parts already proven on other systems is included in _____ (note the appropriate appendix or table No.) _____. The contractor shall use these parts where applicable so as to limit the scope of his parts selection effort. When the contractor is required to establish additional preferred parts lists, the types of parts shall be described in the work statement."

4.2.9

Reliability Demonstration Tests

(Reference NPC 250-1 para. 4.3.4)

The following wording is suggested:

"Reliability demonstration tests will be conducted in accordance with section 3.7 of NPC 500-10. The Reliability Evaluation Plan (per NPC 250-1 para. 4.2) shall identify all items of hardware and the number of each type to be subjected to reliability demonstration tests."

4.3

Specific Quality Oriented Requirements

4.3.1

Inspection System

(Reference NPC 200-3 para. 1.2 and 2.2)

The following wording is suggested:

"The contractor shall develop and implement an Inspection Plan in accordance with the provisions of NPC 200-3. This Inspection Plan shall be a part of the Quality Program Plan. If conflict exists between the provisions of NPC 200-3 and those of the approved Inspection Plan, the latter shall have precedence."

4.3.2

Subcontractor Quality/Inspection Plans

4.3.2.1

(Reference NPC 200-2 para. 1.5 and NPC 200-3 para. 1.5)

When Quality/Inspection program plans for specific subcontractors or for subcontractors of specific equipment are required to be transmitted through (prime contractor) to the (NASA Center) for review or approval, the subcontractor or equipment shall be listed. The following wording is suggested:

"The following subcontractors are required to submit

(Quality and/or Inspection) _____ program plans to

(prime contractor) _____ for transmittal to the
NASA Center):

(name of subcontractor) _____

(name of subcontractor) _____

(name of subcontractor) _____".

4.3.2.2 (Reference NPC 200-2 para. 5.3.1 and NPC 200-3 para. 3.1)
When the prime contractor invokes NPC 200-2 or NPC 200-3 in
subcontracts, the subcontractor shall furnish the required
documentation to him. The prime contractor shall forward
copies to the _____ (NASA Center) _____ or its designated
representative in accordance with the DRL.

4.3.2.3 (Reference NPC 200-2 para. 5.3.1 and NPC 200-3 para. 3.1)
If an equivalent specification is proposed by the prime con-
tractor in lieu of NPC 200-3 for procurements, it shall be
submitted to the _____ (NASA Center) _____ for review at least
two weeks prior to its use in procurement documents.

4.3.2.4 (Reference NPC 200-2 para. 1.2)
When the provisions of NPC 200-2 are to be applied to specific
major subcontracts, the contract shall state the subcontractor
and/or equipment to which this provision applies.

4.3.3 Off-the-Shelf and Commercial Items

(Reference NPC 200-2 para. 5.7 and NPC 200-3 para. 3.1)
When so required by the procuring agency for off-the-shelf and
commercial items, the following statement is suggested to be
included in the work statement:

"All receipts at the contractor's plant, including 'off-the-shelf' and commercial items, shall be clearly identified and this identity maintained in storerooms and during processing in order that items procured under NASA contract may be readily recognized."

4.3.4

Government Furnished Property (GFP)

(Reference NPC 250-1 para. 2.7, NPC 200-2 para. 6.1 and NPC 200-3 para. 3.3)

When it is anticipated or determined that Government Furnished Property (GFP) will be supplied to the contractor, specific instructions regarding the testing, inspection, and handling of the GFP shall be included in the work statement. Also, when GFP is furnished to be used as is without further testing and inspection, this shall be stated.

With respect to GFP the following wording is also suggested:

"Components and subsystems which will be furnished to the contractor by NASA for inclusion in his equipment are identified in (Table X). Their operating and physical characteristics and necessary reliability data are also included in (Table X)."

4.3.5

Failure Reporting

(Reference NPC 250-1 para. 3.7 and NPC 200-2 para. 14.3)
If a specific format and numbering system is desired, so specify.

The extent of laboratory facilities to be established and failure analysis function to be performed by the contractor at the launch site shall be stated. Time periods for

notification of failures and malfunctions and for initiation of corrective action shall be stated.

4.3.6

Waiver of Contractor Responsibility

(Reference NPC 200-2 para. 5.1)

Any waiver of contractor responsibility for certain specific procured items shall be stated, e.g. the following wording is suggested:

"Contractor responsibility is waived for the adequacy and quality of the following items and articles:

(name of article)

(name of article)

(name of article)."

4.3.7

Process Control

(Reference NPC 200-2 para. 13.2 and NPC 200-3 para. 3.7)

Any special processes such as plating, anodizing, radiography, magnetic particle and liquid penetrant inspection, heat treating, welding, soldering, etc., and/or equipment which are required to be approved or certified shall be stated.

Any requirements for personnel certification shall be stated.

4.3.8

Packing & Marking

(Reference NPC 200-2 para. 11.6e and NPC 200-3 para. 3.11)

Any special packing and marking requirements that differ from ICC Regulations shall be stated.

4.3.9

Part Identification

(Reference NPC 200-2 para. 4.4)

A listing of all generic items that do not require serialization of identification by lot number after fabrication shall be included in the work statement.

4.3.10

Qualification Test Procedures

(Reference NPC 200-2 para. 4.3.1)

Any additional requirements beyond NPC 200-2, Paragraph 4.3.1, for documentation and submittal of qualification test procedures shall be described.

4.3.11

Qualification Status Lists

(Reference NPC 200-2 para. 4.3.5)

The following wording is suggested:

"The qualification status lists shall be submitted for approval to the (NASA Center) initially and at intervals in accordance with the DRL."

4.3.12

Verification Tests of Raw Materials

(Reference NPC 200-3 para. 3.5)

The following wording is suggested:

"Suppliers of fabricated articles shall supply test specimens of raw materials with the fabricated articles for verification tests as required by the (NASA Center)."

4.3.13

Inspection & Tests

(Reference NPC 200-3 para. 3.6 and 3.12)

Inspections and tests desired but not contained in specifications and standards referenced in this work statement shall be stated. Requirements for sampling inspection, if applicable, or special instructions for screening inspection in lieu of sampling shall be stated.

4.3.14

Electronic Data Processing

(Reference NPC 200-2 para. 4.2.1 and 4.4; and NPC 200-3 para. 3.13)

When electronic or mechanized data processing is required by the

procuring agency, the requirements for such data processing shall be defined in the work statement.

4,4

Matrix of R&QA Requirements for Apollo Program Hardware

The following pages show a series of R&QA Discipline Charts. Each R&QA discipline is followed by one or more references to Apollo Program and/or NASA documents as the authority for that discipline. Also following each discipline are references to designated hardware development phases. The designations generally correspond to those in the Apollo R&QA Program Plan, NHB 5300.1 of October 1965. Disciplines appropriate to each phase are indicated by asterisks (*) below the appropriate phase(s).

Based on inputs from the Center R&QA Office, the Contracting Officer may then specify on the RFP selected R&QA hardware disciplines (from the charts) and their appropriate hardware development phases that the contractor must implement on a particular contract.

Hardware development phases not according to NHB-500-5
 Have never seen NHB 5300.1 - May be Computable

RELIABILITY & QUALITY ASSURANCE REQUIREMENTS FOR APOLLO PROGRAM HARDWARE																	
ITEM	R&QA PROGRAM DISCIPLINE	AUTHORITY								HARDWARE DEVELOPMENT PHASE							
		NPC 500-10	NPC 400 Para. 1,5106	NPC 400 Subpart 50	NPC C500	NHB 5300.1	NPC 250-1	NPC 200-2	NPC 200-3	STUDY	DEFINITION	DESIGN	DEVELOPMENT	MANUFACTURING	TEST	OPERATIONS	SUPPORT SERVICES
1.	R&QA Program Plan (Including Inspection Plan)		(b) i, ii ✓	1,5005 ✓	10.5.4 ✓	2.2.2a 2.2.3a 3.4 ✓	2.2 ✓	3.1.1 ✓	2.2 ✓	* ✓	*	* ✓	*	* ✓	*		
2.	R&QA Program Management & Control		(b) iii		1.2 10.5.4 10.6.3 10.7	3.4b	2.4 2.6	3.2		*	*	*	*	*	*	*	*
3.	R&QA Program Requirements			1,5005	10.3 10.6	Sect. 2	Sections 2, 3 & 4	1.2	1.2	*	*	*	*	*	*	*	*
4.	R&QA Documentation Adm. & Reqmts.		(a) iv	1,5005	4.2	2.3.9	5.1	2.2 14.1 14.2 App. B	1.1, 2.2, 3.6, & 3.13	*	*	*	*	*	*	*	*
5.	R&QA Program Reporting Requirements		(b) xiii		10.6.12	2.2.8b, 5.4, 5.5	5.2 5.3	14.2.1 14.2.4		*	*	*	*	*	*	*	*
6.	R&QA Program Reviews					2.2.3w 3.2.4f	2.3					*	*	*	*	*	*
7.	R&QA Program Audits & Monitoring		(a) (b) v		10.6.12 10.7	2.2.8d Sect. 6	2.1 2.3,2.4 2.6.3 3.2	Sect. 15				*	*	*	*	*	*
8.	Design Reviews (R&QA Participation)				10.6.4	2.2.3 p,w 2.2.4 f 2.2.7 d	3.2 3.6	4.2.1				*	*	*	*		
9.	Review Design Practices, from R&QA Standpoint, for Standardization		(a) ii				3.8					*	*				
10.	Configuration Management (per NPC 500-1, 6.0) as related to R&QA				5.2	2.2.3x 2.2.4c 2.2.5b 2.2.6c 2.2.7d 2.3.7	3.6.3	2.3	2.4		*	*	*	*	*	*	
11.	Data Collection & Analysis (Reliab.&Qual; and Test as related to R&QA)	6.4	(a) iv	1,5005	10.6.6 10.6.9 10.6.11	2.2.8a 2.5 4.7 7.3.3 7.4.7 7.5	5.1	Sect. 14	3.14			*	*	*	*	*	*

RELIABILITY & QUALITY ASSURANCE REQUIREMENTS FOR APOLLO PROGRAM HARDWARE																	
ITEM	R&QA PROGRAM DISCIPLINE	AUTHORITY								HARDWARE DEVELOPMENT PHASE							
		NPC 500-10	NPC 400 Para. 1.5106	NPC 400 Subpart 50	NPC C500	NHB 5300.1	NPC 250-1	NPC 200-2	NPC 200-3	STUDY	DEFINITION	DESIGN	DEVELOPMENT	MANUFACTURING	TEST	OPERATIONS	SUPPORT SERVICES
12.	Logistics (NPC 500-3) as related to R&QA (Maintenance, Supply, Transportation - Preservation, Packaging, Handling, Storage & Shipping)		(a) i		Sect. 6 10.6.3	2.2.3k 2.2.6b 2.3.8	3.5	Sect. 11	3.4 3.11					*	*	*	
13.	Training & Motivation (R&QA). (Including Personnel Certification)				10.6.13	2.2.4a 2.2.8c 2.3.2c	2.5 3.5b	Sect. 13	3.7			*	*	*	*	*	*
14.	R&QA Analysis of Operational & Pre-launch considerations (Opn'l gnd. rules; contingency plans concerning countdown, holds, scrubs, aborts, and alternative missions; pre-launch troubles; constraints, waivers, deviations, modifications, discrepancies; and adequacy of corrective actions)				10.4 10.6.1 10.6.9	2.2.6h 2.2.6f Sect. 4									*	*	
15.	FRR's (R&QA Participation)				14.7.2.5	2.2.6j										*	
16.	Relationship of Quality to Reliability			1.5005	10.4	2.3.3 2.3.4		1.4	1.4	*	*	*	*	*	*	*	*
17.	Parts & Materials Program		(b) ix, i	1.5005	10.6.5	2.2.3m Sect. 7	3.9.2 3.9.5 3.9.6	4.2.2				*	*	*	*	*	*
18.	Mission Profile Analysis				10.6.1	2.2.3c 2.2.6g 4.7a(1)	3.2.1				*	*	*	*	*	*	
19.	Reliability Goals & Apportionment				10.3 10.6.8	2.2.2c 2.2.3g 2.3.6 4.2 b (1) 4.7 a (5)					*	*	*	*	*		
20.	System/Functional, Logic/block diagrams and Math Model.		(b) vii (b) xii		10.6.9	2.2.2b 2.2.3b, c, e 2.2.4h, i Sect. 4	3.2.2 3.3 4.4					*	*	*	*	*	
21.	Reliability Predictions & Assessments	2.2.6			10.6.8 10.6.9 10.7	2.2.2b 2.2.3e 2.2.4 i 2.2.6 i Sect.4	3.3 4.4					*	*	*	*	*	
22.	Reliability Evaluation Program	2.2.6	(b) i, ii		10.5.4	2.2.3q 3.4	Sect. 4							*	*	*	

RELIABILITY & QUALITY ASSURANCE REQUIREMENTS FOR APOLLO PROGRAM HARDWARE																
ITEM	R&QA PROGRAM DISCIPLINE	AUTHORITY								HARDWARE DEVELOPMENT PHASE						
		NPC 500-10	NPC 400 Para. 1.5106	NPC 400 Subpart 50	NPC C500	NHB 5300.1	NPC 250-1	NPC 200-2	NPC 200-3	STUDY	DEFINITION	DESIGN	DEVELOPMENT	MANUFACTURING	TEST	OPERATIONS SUPPORT SERVICES
23.	Analysis of feasible alternatives to achieve goals; trade-off studies.				10.6.8 10.6.9	2.2.2d 2.2.3f 2.2.7d Sect. 4	3.3 3.4					*	*	*	*	*
24.	Failure Mode, Effect & Criticality Analysis (FMECA); and determination of critical items (including GSE).				10.6.2 10.6.4 10.6.10	2.2.3d 2.2.3o 2.2.4g 2.7 4.7a(6), (7) 7.5.3f, g	3.4					*	*	*	*	
25.	Redundancy Reqmts. (Eqpt.-human-logistics)				10.6.8	2.2.3j	3.3					*	*	*	*	
26.	Program to minimize human-induced failures.		(a) i			2.2.3i 2.6.1a	3.5					*	*	*	*	
27.	Maintainability Analysis		(a) i			2.2.3k	3.5					*	*	*	*	
28.	Post-Flight Reliab. Analysis & Evaluation	4.3.9 4.3.10 4.3.11				2.2.5j 2.2.7 2.6.2										*
29.	Parts Identification & Traceability			1.5005	10.6.5	2.2.3n 7.2e 7.4.2 7.4.10		4.4 5.7						*	*	
30.	Control of raw material, purchased parts, GFE, and incoming material; and selection of procurement sources.		(b) vi	1.5005	10.6.3 10.7	2.2.3r 2.2.3s 2.2.4b 7.4.5	2.7	5.2,5.3.1, 5.4,5.5,5.6 5.7,6.1,6.2	3.1, 3.3, 3.4, 3.5, 3.6			*	*			
31.	Failure reporting, failure analysis & corrective action (including UCR's)	6.5	(b) viii		10.6.5 10.6.6 10.6.11	2.2.3t 2.2.4m 2.2.5g,j 2.2.6f 2.2.7c 2.6 5.2.3 7.4.7	3.7	5.8 6.2 Sect. 14					*	*	*	
32.	Statistical Q.C. & Sampling				10.6.5			4.2.1 Sect. 12						*	*	
33.	In-process Inspection			1.5005		2.2.3s 2.2.4b 2.2.5a 2.2.6a 7.4.9		7.3 7.4	3.6				*			

RELIABILITY & QUALITY ASSURANCE REQUIREMENTS FOR APOLLO PROGRAM HARDWARE																	
ITEM	R&QA PROGRAM DISCIPLINE	AUTHORITY								HARDWARE DEVELOPMENT PHASE							
		NPC 500-10	NPC 400 Para. 1.5106	NPC 400 Subpart 50	NPC C500	NHB 5300.1	NPC 250-1	NPC 200-2	NPC 200-3	STUDY	DEFINITION	DESIGN	DEVELOPMENT	MANUFACTURING	TEST	OPERATIONS	SUPPORT SERVICES
34.	Control & Standardization of Processes & Process Specs; and Process Certification					2.2.3r 7.4.8	3.8	4.4 7.5.4	3.7					*	*		
35.	Standardization & Control of Fabrication & Assembly Practices					2.2.3r 7.4.8	3.8	7.3 7.4 7.5						*	*		
36.	Inspection Stamp Control					2.2.3s 2.2.4e 2.3.2b		5.7 Sect. 10	3.10					*	*		
37.	Non-Conforming Mat'l & MRB Action				10.6.3	2.2.4d 2.2.6f		Sect. 8 10.1a	3.8					*	*		
38.	Equipment Logs					2.2.4n 2.2.5h 2.2.6e	3.10							*	*		
39.	Maint. & Calibration of Inspection, Measuring & Test Equipment	3.3.8.2			10.6.3	2.2.3r 2.3.11	3.10f 4.3.3b	5.10 Sect. 9	3.9					*	*		
40.	Govt. Q. A. Activity	1.3 2.2.8			10.2.2 10.2.5 10.3.2 10.5.3 10.6.6 10.6.7 10.7	2.2.4d 2.2.4o 2.3.4 2.4.5 3.3 5.4 6.3.6	1.4.1	1.5 5.3.1b 5.4 8.2	1.5			*	*	*	*		
41.	Parts Qualification Test Program				12.4.1 12.4.2	2.2.3v 2.2.4j 2.2.5c 2.2.6e 7.4.6	3.9.4					*	*	*	*		
42.	Reliab. Demonstration Test Program	2.4.4 3.7	(b) xi		10.6.6 10.4 12.4.3	2.2.3v 2.2.4k 2.2.5d 2.3.10	4.3.4							*	*		
43.	Overall Test Program (R&QA participation in development, review for R&QA impact, verification, recommendation for revision based on R&QA analysis, and Test/Reliab./Quality relationship).	1.3 2.3 3.2 3.3 6.2	(a) III(A)		10.3 10.6.2 12.1	2.2.3u 2.2.5j 2.2.7e 2.3.2a (3) 2.3.10	1.3.2 3.3b 3.5a Sect. 4	1.4 2.1 4.2.1 12.2			*	*	*	*	*	*	
43A.	Development Testing	3.4	(a) III		10.6.6 12.4.1			4.3					*	*	*		

RELIABILITY & QUALITY ASSURANCE REQUIREMENTS FOR APOLLO PROGRAM HARDWARE																
ITEM	R&QA PROGRAM DISCIPLINE	AUTHORITY								HARDWARE DEVELOPMENT PHASE						
		NPC 500-10	NPC 400 Para. 1.5106	NPC 400 Subpart 50	NPC C500	NHB 5300.1	NPC 250-1	NPC 200-2	NPC 200-3	STUDY	DEFINITION	DESIGN	DEVELOPMENT	MANUFACTURING	TEST	SUPPORT SERVICES
43B.	End-Item Acceptance Testing	3.8	(a) III (C)		10.6.3 10.6.6 12.4.4	2.2.3s 2.2.4i 2.2.4o 2.2.5e		4.3 7.3 7.4	3.6					*	*	
43C.	Qualification Testing	3.6	(a) III (B)	1.5005	10.6.6 12.4.2	2.2.3t 2.2.3v 2.2.4j 2.2.4m 2.2.5c 2.2.5g 2.2.6e 7.4.6	3.9.4	4.3						*	*	
43D.	Reliab. Demonstration Testing	2.4.4 3.7			10.4 10.6.6 12.4.3	2.2.3v 2.2.4k 2.2.5d	4.3.4							*	*	
43E.	Pre-use checkout of GSE & Pre-launch Checkout of Flt. Hdw.	3.9, 3.10			10.6.6 12.4.4 12.4.5	2.2.5f 2.2.6b 2.2.6d 2.7									*	*
43F.	Flight Testing	Sect. 4			12.4.7 12.4.8											*
43G.	Post-Flight Testing	3.11			10.6.6 12.4.6											*
44.	Acceptance Criteria and Procedures; Reviews (including narrative end-item reports)	3.8	(a) III		10.6.7	2.2.3s 2.2.4f 2.2.4i 2.2.4o 2.2.5e 2.2.6e	3.2.1 3.5a 3.9.3 4.3.3	5.1 7.2 7.3.1 7.4.2.2	3.6			*	*	*	*	*
45.	COFW (R&QA Participation)	2.4.5 3.3.6			10.6.7 12.1	2.2.4p 2.2.5i								*	*	
46.	Safety (Industrial & Flight) (R&QA)				10.2.4 10.6.8 11.2.1	2.2.2c 2.3.1	3.5			*	*	*	*	*	*	*